CPU COOLING DEVICE

Inventor:
Chen Shih-Tsung

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the right of priority based on Taiwan application serial no. 091209840, filed on June 28, 2002, which is herein incorporated in its entirety by reference.

BACKGROUND

Field of the Invention

[0002] The present invention relates generally to cooling a central processing unit (CPU) in a computer system, and in particular to cooling a CPU using a heat sink maintained in good thermal contact with the CPU.

Background of the Invention

[0003] The function of a computer's central processing unit (CPU) plays an important role in the effectiveness of the computer. For this reason, manufactures conduct research and development to improve the functionality of the computer to meet the needs of users. Research and development continue to produce computers with increasing capacity, faster operational speeds, and more powerful functionalities. In large part, these improvements are due to the efforts to create a more powerful CPU.

[0004] In a conventional computer assembly, heat dissipation is performed by way of attaching a heat sink on top of the CPU. The heat sink includes a plurality of cooling fins on the top and/or sides of the heat sink so that heat is guided via conduction from the CPU to the bottom of the heat sink contacting with the CPU, and then to the cooling fins. The conduction of heat out of the computer housing may be further facilitated by a cooling fan that passes a flow of air over the cooling fins. Regardless of specific implementations, efficient heat dissipation from the CPU is promoted by good thermal contact between the CPU and the heat sink, which depends on how well the heat sink is secured to the CPU.

[0005] Existing methods for attaching a heat sink to a CPU have some drawbacks. One deficiency is that the heat sink and the CPU may not maintain good thermal contact to each other during operation of the computer. Keeping good thermal contact between the heat sink and the CPU is important for effective heat conduction; otherwise, the heat conduction from the CPU to the heat sink becomes less effective. Additionally, attaching a heat sink to the CPU may require special tools or joining components. Further, for heat sinks that have a lateral side attached to an auxiliary cooling device (e.g., by one or more heat pipes), the center of gravity of the heat sink and cooling device assembly is not aligned with the CPU. This may cause the heat sink to lift off from horizontal contact with the CPU unless the heat sink is secured to the CPU tightly.

SUMMARY OF THE INVENTION

[0006] In one embodiment of the invention, a CPU cooling assembly is provided for cooling a CPU installed in a CPU frame. Although the cooling assembly can be used with a number of different types of CPU frames, one such type has a plurality of engaging juts extending outward from opposite lateral sides of the CPU frame. The cooling assembly comprises a heat sink and a retainer. The heat sink includes a plurality of spaced apart cooling fins at an upper portion of the heat sink for dissipating heat. The heat sink further including a positioning groove for receiving the retainer. The retainer includes opposing engaging plates coupled by a connecting bar. The connecting bar corresponding to the positioning groove of the heat sink so that the connecting bar is received within the positioning groove when the retainer is placed over the heat sink and engaged with the CPU frame. The engaging plates of the retainer have a plurality of engaging holes that correspond to the engaging juts of the CPU frame. The retainer may further include a turn plate attached to an engaging plate, wherein the engaging plate can be turned to engage or disengage with engaging juts by activation of the turn plate.

[0007] In operation, the heat sink is placed on the CPU frame, and the retainer engages with the CPU frame and is received within the positioning groove of the heat sink. The result is to tightly secure the heat sink to the CPU frame and CPU, thereby creating a good thermal coupling between the CPU and the heat sink. The retainer is disengaged from the CPU base by pressing on the turn plate, and the cooling assembly can then be removed form the CPU frame and CPU.

[0008] The novel features of the invention are set forth with particularity in the appended claims. The invention will be best understood from the following description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Fig. 1 is a disassembled view of a CPU cooling assembly in accordance with an embodiment of the present invention.

[0010] Fig. 2 is a front view of an assembled CPU cooling assembly in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] Figs. 1 and 2 illustrate an embodiment of a CPU cooling assembly in accordance with an embodiment of the present invention. Fig. 1 show a disassembled view of the CPU cooling assembly, and Fig. 2 shows an assembled view of the same. The CPU cooling assembly includes a heat sink 1, a retainer 2, and CPU frame 4. The heat sink 1 is configured to engage to the CPU frame 4 and make thermal contact with a CPU installed in the CPU frame 4. As used herein, thermal contact or thermal coupling means that heat energy can pass from one object to another; actual physical contact is not necessarily required. Accordingly, two objects can be in thermal contact or thermally coupled, even though there may be a heat conductive element disposed therebetween. The retainer 2 is used to secure the heat sink 1 in thermal contact with the CPU.

[0012] The CPU frame 4 may be a proprietary CPU frame or one defined by a standard specification. In one embodiment, the CPU frame 4 is a zero input force (ZIF) frame, such as a K7-type ZIF CPU frame. In a ZIF frame, a CPU is placed in a cavity in the center of the ZIF CPU frame and removed from that cavity by way of operating a lateral push lever. The ZIF CPU frame 4 includes at two opposing sides a plurality of engaging juts 41 extending therefrom. Other types of CPU frames can also be used with the present invention.

[0013] The heat sink 1 is made of a heat conductive material – usually a metal – and the bottom thereof is adapted to make thermal contact with a CPU in an assembled state. Accordingly, the bottom of the heat sink 1 is typically flat, corresponding to the surface of a typical CPU. To facilitate radiation of the heat from the heat sink 1 and to guide the heat out with an optional fan, the heat sink 1 includes a plurality of upright spaced apart cooling fins 11. The cooling fins 11 are typically disposed on a top surface of the heat sink 1. Additionally, to accommodate the retainer 2, one or more positioning grooves 12 are formed in the cooing fins 11 as shown in Fig. 1. In Fig. 1, three positioning grooves 12 are provided in the cooling fins 11, the three positioning grooves 12 corresponding to the engaging juts 41 of the CPU frame 41; however, any number of positioning grooves 12 can be arranged.

[0014] The retainer 2 includes a pair of opposing engaging plates 21 coupled by a connecting bar 23. The engaging plates are provided with engaging holes 22 that correspond to the engaging juts 41. A connecting bar 23 joins the engaging plates 21, and the connecting bar 23 inclines downward from the engaging plates 21 to an intermediate position (which may or may not be an equal distance from each engaging

plate 21). Although two connecting bars 23 are illustrated in Fig. 1, a single connecting bar 23 or any number of connecting bars 23 can be arranged. In one embodiment, a turn plate 24 extends from an engaging plate 21 at the top end thereof. The turn plate 24 is used to facilitate the engaging and disengaging of the retainer 2 with the CPU frame 4.

[0015] In one embodiment, the retainer 2 is made of a heat conductive metal to further facilitate the dissipation of heat from the CPU. The retainer 2 may also be constructed from sheet metal and formed of an integral part by way of stamping.

[0016] In one embodiment, a restraining element 3 is used to fixedly position the heat sink 1. The heat sink 1 is provided with a holding groove 13 to receive the restraining element 3. The holding groove 13 is formed within the cooling fins 11. Although the cooling fins 11 are shown parallel with the holding groove 3 and perpendicular to the positioning grooves, the cooling fins 11 may be oriented in any direction. In the embodiment shown, the restraining element 3 has a curved cross section and a length substantially corresponding to the holding groove 13. The width of the restraining element 3 is a little greater than the width of the holding groove 13 so that the restraining element 3 must be compressed to fit within the holding groove 13. Accordingly, the restraining element 3 is resilient under a force. Furthermore, the restraining element 3 may be made of a heat conductive material (such as a metal).

[0017] With reference to Figs. 1 and 2, the cooling apparatus is installed over a CPU by placing the heat sink 1 over the CPU frame 4 in which a CPU is installed. The retainer 2 is then placed over the heat sink 1 such that the positioning grooves 12 of the heat sink 1 receive the connecting bar 23 of the retainer 2. The engaging holes 22 of an engaging plate 21 of the retainer 22 are fitted over the engaging juts 41 of the CPU frame

4. The engaging holes 22 of an opposite engaging plate 21 of the retainer 2 are then fitted over the engaging juts 41 of the opposite side of the CPU frame 4. This step is performed by way of the flexibility of the material of the retainer 2. Once the retainer 2 is engaged with the CPU frame 4, the connecting bar 23 of the retainer 2 presses downward against the heat sink 1 to secure the heat sink 1 tightly against the CPU.

[0018] In one embodiment, the restraining element 3 is further compressed and inserted into the holding groove 13 with the open side of the restraining element 3 facing upward so that its internal force creates a sufficient frictional force with the holding groove 13 so that the restraining element 3 remains in place. With the restraining element 3 installed in the holding groove 13, the retainer 2 will not fall out of the heat sink 1 if it is later disengaged form the CPU frame 4.

[0019] To disengage the cooling assembly from the CPU frame 4, the turn plate 24 of the retainer 2 is pressed inward so that the engaging holes 22 at the same lateral side thereof are detached from the engaging juts 41 of the CPU frame 4. The engaging holes 22 from the opposite lateral side are then detached from their respective engaging juts 41, and the cooling assembly can be removed from the CPU frame 4.

[0020] To separate the retainer 2 from the heat sink 1 in an embodiment where a restraining element 3 is used, the restraining element 3 is compressed and removed from the top of the holding groove 3. The retainer 2 can then be removed from the heat sink 1 by slipping it out of the positioning grooves 12 of the heat sink 1.

[0021] It can be seen that the CPU cooling assembly in accordance with the present invention enables the heat sink 1 to be secured and in good thermal contact with a CPU. Moreover, the cooling apparatus provides for easy and quick assembly without the need

for special tools. Beneficially, the cooling apparatus allows for heat to be guided continuously from a CPU. Because the cooling assembly can be tightly secured to a CPU frame and CPU, the invention allows for the use of a heat sink attached to an auxiliary cooling device (e.g., to a radiator coupled to the heat sink by one or more heat pipes), where the center of the gravity of the entire cooling apparatus deviates due to the addition of the auxiliary cooling device mounted to the heat sink.

[0022] The foregoing description of the embodiments of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Persons skilled in the relevant art can appreciate that many modifications and variations are possible in light of the above teaching. It is therefore intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.